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Do I walk or ride the rickshaw? Examining the factors affecting first- and last-mile trip options in the historic district of Manila (Philippines)

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Abstract: Historic urban centers (HUCs) such as the Ermita District in Manila display a compact, mixed, and human-scale urban form. Because of these features, people in these areas still depend on either walking or riding a pedicab (also known as cycle rickshaws) to reach their destinations. The latter mode, considered an informal non-motorized transport (NMT), is widely preferred by commuters as their first- and last-mile trip option to navigate the narrow street network of these historic districts. However, it is unclear what factors affect an individual's first- and last-mile choices. Through a face-to-face intercept survey, respondents were asked about their relative preference between the two mode choices to capture the factors that influenced their decision to walk or to ride the pedicab within Ermita. By utilizing logit choice analysis, the study identified statistically significant mode-specific, as well as qualitative, variables that influenced individual decisions. The probability outcome showed that the most significant factors were access and/or egress time, cost over travel time, safety, and accessibility of the walking environment. It is also important to note that pedicab users had a longer average trip distance (about a kilometer) than walkers, and women, including those who were accompanied by children, preferred to use pedicabs. Results from this study can help district-level planning and policymaking in three ways: (1) by improving the physical environment through encouraging the use of NMT such as walking and pedicab riding as crucial first- and/or last-mile options for individuals in HUCs; (2) by aligning routes and regulations for pedicab services to be part of an overall transport service provision, and (3) by undertaking infrastructure improvements for safer walkway environments for pedestrians, considering the implications of walking and pedicab riding to individual, population-level health outcomes and overall quality of life.

Keywords: mode choice, active travel, informal transport, walking, rickshaw, pedicab

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1 Introduction

In developing cities such as Manila (Philippines), the way individuals travel to and within Historic Urban Centers (HUC) presents a unique but complex land use and transport interaction that brings to the fore a diverse yet unique set of urban challenges in these cities (Dimitriou & Gakenheimer, 2011). For instance, the narrow road networks within Manila's HUCs, originally designed to accommodate pedestrians, are now clogged and congested, unable to support the steep increase in the volume of automobile traffic. Thus, several transport options have emerged as alternative modes to respond to increasing passenger travel demand and provide transport options to the often unreliable and inconvenient formal public transport services (Dimitriou, 2013). The diverse set of modes, both formal and informal, plying the area include light rail transit (LRT), mini-buses/buses, "jeepneys" (a type of a public utility vehicle that is a US army surplus Jeep reconditioned right after World War II), all-utility vehicles (AUVs), taxis and shared taxis, tricycles, and pedicabs (rickshaws). Based on a 2014 JICA study, the modal share of individuals traveling to Manila is as follows: (a) car (32%); (b) jeepney (42%), and (c) bus (26%). In general, informal transport modes have been widely tolerated by authorities because they fill a crucial gap in the transport network as well as provide a more convenient and responsive transport alternative that caters to the varying requirements of different transport users (e.g., passengers, drivers, public transport operators) (Mateo-Babiano, 2016a). While these conditions have brought a distinct set of challenges to the daily commute, they have also presented opportunities for cities to achieve sustainable and inclusive urban environments.

Because they have evolved traditionally and historically, thriving HUCs, such as the Ermita district in Manila, are typically characterized by compact land-use setting, high population and employment density, and relatively short trip distances between origins and destinations (refer to Section 3.1 for a discussion about the case study area's land-use characteristics) (Munshi, 2016). Cervero (2013) posits that these characteristics encourage the use of more sustainable, active travel such as walking and cycling. Within Ermita's mixed, human-scale urban form, the majority of the population are "captive" pedestrians who continue to depend on walking or taking informal transport such as the ubiquitous cycle rickshaw, known locally as pedicab, as their first- or last-mile transport alternative (Mateo-Babiano, 2016b).

Cycle rickshaws or pedicabs (whose typical dimension is shown in Figure 1) are three-wheeled, non-motorized vehicles. Because they are slow moving, rickshaws have been blamed several times as severely contributing to traffic congestion (Dimitriou, 2013). Because of this, local government regulations have been put in place as an attempt to control or even rid the streets of pedicabs. In 1990, the Metro Manila Council, the governing body and policymaking body of the Metropolitan Manila Development Authority (MMDA), which includes the City of Manila, passed Ordinance No. 6. The ordinance contains a provision that limits the operation of tricycles and pedicabs within local tertiary roads and subdivision roads of local governments. To further reinforce the banning of pedicabs, the Department of Interior and Local Government (DILG), a state agency whose key mandate is to enhance the performance of local government units (LGUs), also issued Memo Circular 2007-01 that disallowed the operation of tricycles and pedicabs along national highways. Within the city of Manila, the city government also passed a regulation, Ordinance No. 8291, that established the guidelines for the operation and registration of tricycles and pedicabs. These modes are banned from 46 streets in Manila City (some of these streets are marked in red in Figure 2). But because they complement and supplement the transport system, their presence persists in the urbanscape of Manila as well as in most South and Southeast Asian cities (Mateo-Babiano, 2016a; Munshi, 2016).

Moreover, research literature provides evidence of the vital role of rickshaws in the global South. For instance, pedicabs or rickshaws have an important role to play in ferrying children to school (Tetali, Edwards, & Roberts, 2016). In addition, pedicabs have shown versatility in ferrying people through knee-deep waters during flooding occurrence (Mateo-Babiano, Susilo, Joewono, Vu, & Guillen, 2013). As it does not use fuel, it is one of the most environment-friendly modes (Tiwari, 2015). From an economic perspective, pedicab operation may serve as a point of entry for workers into the local economy (Tamanna & Hassan, 2015). Moreover, given their rampant presence, they have become a culturally acceptable indigenous transport mode, catering to the mobility needs of local people (Cervero, 2000; Mateo-Babiano, 2016a). Particularly within HUCs, riding a pedicab is recognized as a commuter's preferred first-/last-mile option to navigate the narrow street network of historic districts to be able to reach their destinations.

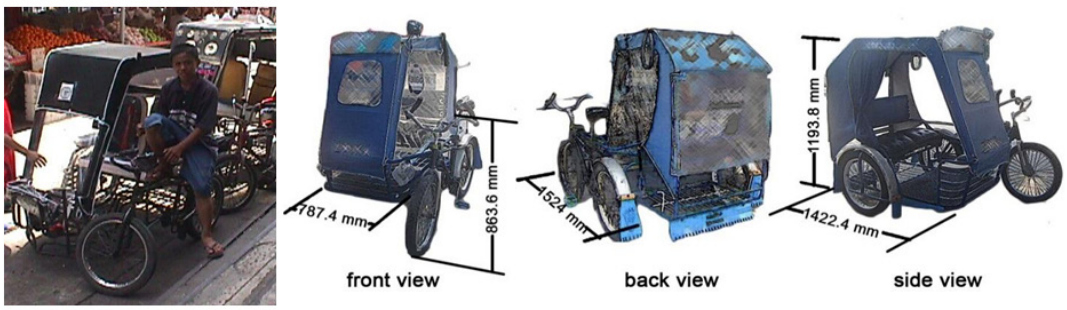

Figure 1: The rickshaw (i.e., pedicab) typical dimension (Source: Jayme & Sia, 2011)

To date, no study has comprehensively examined commuter's first- and last-mile preference and experience in the context of historic districts in Philippine cities. In addition, while it appears that a significant proportion of cities still allow pedicabs to operate and cater to trips shorter than two kilometers, its use, preference, and the factors considered to influence an individual's decision making and choice to ride a pedicab is not well understood, particularly when compared to walking. This paper fills this gap. Therefore, this paper aims to investigate the factors that influenced the access/egress mode choice of whether to walk or to take the pedicab within Manila's historic streets.

This paper is structured in the following manner: Section 2 discusses the review of related literature on factors influencing mode choice decisions, while Section 3 describes the data needs and methodology. This is followed by the results and findings that report on the survey outcomes while the last section's discussion and conclusion draws upon the earlier chapters to articulate the implications of the survey outcomes to planning and policymaking.

2 Literature review

Ecological models claim that active travel mode choice decisions are influenced by multiple factors. These factors may include intrapersonal/individual, interpersonal, community, and policy (McLeroy, Steckler, & Bibeau, 1988). Several works of literature recognize that the best transportation system is one that informs its development and provision based on the perspectives of its users. A user-centered approach acknowledges the role of passengers and users as agents of change. At the user level, transport must provide the required level of accessibility, mobility and mode-specific quality of service requirements of users. Zhou (2012) suggested six (6) types of factors, which are typically used in the study of mode choice. These are: (a) individual characteristics (socio-economic and demographic); (b) mode-specific service quality/characteristics; (c) psychological attributes (e.g. attitudes); (d) trip characteristics (specific to a mode); (e) built environment attributes; and (6) Transport Demand Management (TDM) measures.

Individual factors such as age and gender (Ghani, Rachele, Washington, & Turrell, 2016; Adeel, Yeh, & Zhang, 2017), as well as trip characteristics (e.g., trip purpose), influence travel behavior. While walking is known to be the most popular form of physical activity among the older members of society (Satariano et al., 2012; Touvier et al., 2010), seniors however often walk more for recreation (Van Dyck et al., 2013) and less for transport (Doescher et al., 2014; Turrell, Hewitt, Haynes, Nathan, & Giles-Corti, 2014). In terms of gender, women are less likely to walk than men for utilitarian purposes (Sundquist et al., 2011; Doescher et al., 2014) or recreation purposes (Sundquist et al., 2011). There has been a long-standing recognition of the extent to which attitudes and preferences affect mode choice (Cao, Mokhtarian, & Handy, 2009; Van Acker, Mokhtarian, & Witlox, 2011). A study by Panter and Jones (2010) found that accessibility and safety of neighborhoods may be important contributory factors to active travel choice (Panter & Jones 2010; Saelens & Handy, 2008) while environment which is perceived to be lacking in safety discourage walking and cycling, subsequently limiting the participation of individuals in daily socio-economic opportunities. This perception is not without a basis. World Health Organization data (WHO, 2013) show that pedestrians comprise approximately 45 percent of those dying on the roads in low-income countries, and 29 percent in middle-income countries.

Attitudes impact travel decisions. As an example, a study conducted by Gatersleben and Haddad (2010) showed that individuals who have adopted cycling as a mode choice have positive perceptions of cyclists and cycling in general, relative to those who have not adopted cycling as a form of transportation (Gatersleben & Appleton, 2007; Gatersleben & Haddad, 2010). In terms of preferences, a stated preference study that investigated the behavior of teenagers on walking or cycling (in the US) found that willingness to walk and to cycle has a positive effect on the choice of those alternatives, while it presented a negative effect on the choice of a car (Kamargianni & Polydoropoulou, 2013). Household structure is also known to affect travel decisions. Cao et al. (2009) reported that the number of children under the age of five in a family is an important determinant of the number of car trips one makes (Cao et al. 2009). Similarly, Delmelle and Delmelle (2012) reported that the number of children in a family is negatively correlated with the probability of walking and cycling.

Built environment attributes such as a compact urban form, land use mix, street connectivity, infrastructure, accessibility of services and facilities, and distance to transit and destination accessibility are associated with active transport modes such as walking and cycling (Cervero, 1996; Cervero & Radisch, 1996; Cervero & Murakami, 2008; Frank et al., 2006; Humpel, Owen, & Leslie, 2002). These characteristics, systematized by Ewing and Cervero (2010) as the "5D of a walkable environment," are arguably built environment attributes that attract more walking. A walkable environment is said to attract more walks that are incidental. Walkability has been defined by Litman as the quality of walking conditions provided, including safety, comfort, and convenience (Litman, 2010). However, it is acknowledged that walkability also has several dimensions such as connectivity, pedestrian route choice factors, street network legibility, access or the ability to reach desired goods, services and activities as an important part of walkability. The relationship between walkable environments and the decision to walk is very complex and not well understood, hence, requiring further research.

While walking studies have been extensively researched, the study of rickshaw (pedicab) as part of a transport mode choice study has been limited and generally contextualized in developing cities (Munshi, 2016). Part of the reason is their rampant presence in these cities and their stark absence in developed contexts. The use of rickshaw as a mode choice has also been associated with socio-demographic characteristics including gender, household income, and marital status (Adeel et al., 2017). Tiwari (2015) reports that Indian cities currently favor active travel mode shares. However, the figures are declining because of the poor quality of public infrastructure resulting from the limited government investment in active transport infrastructure (Tiwari, 2015; Tiwari, Jain, & Rao, 2016). Tiwari (2015) further cautions that a business as usual scenario may encourage a shift to personal motorized vehicles when incomes increase (Tiwari, 2015).

Results of the literature review demonstrate that several factors contribute to individual travel decisions, resulting in levels of propensity of walking and/or use of pedicab. This information clearly reinforces the fact that not one but a combination of several factors influence travel decisions. In fact, a mix of these environmental attributes with infrastructure, neighborhood characteristics and social circumstances may influence travel behavior (Pont, Ziviani, Wadley, Bennett, & Abbott, 2009). Such information provides important insights on planning and policymaking towards encouraging greener travel behaviors.

3 Data and methodology

Modelling an individual's relative preference for a specific transport mode choice is crucial to be able to capture the factors that influence his or her preference from among given mode choice alternatives. By using logit choice analysis, this study modeled the decision to either walk or ride the pedicab within Ermita's streets. Logit choice models provide an appropriate analytical framework to determine choice probabilities. Moreover, because it takes a closed form, results are readily interpretable (McFadden, 2001). Subsection 3.1 describes the case study area and survey locations. This is followed by a detailed description of the data collection methodology employed in the study.

3.1 The case study area: Ermita, Manila

The project was conducted in Ermita, the fifth district of Manila City in the Philippines. Ermita District has a population of 10,523 (NSO, 2015) within a land area of 2.49 sq.km. It has a population density of 4,211/km2, one of the highest in the world. The district is where the seat of the City government is located. At the same time, it also plays an important role as the City's center of culture, commerce, finance, and education. Most importantly, from a historical perspective, it has continued to be a well-known university district known locally as the U-Belt, serving as home to several university campuses and dormitories. Because it is in the heart of the metropolitan region, the area is very accessible via several major roads. Three major roads (i.e., United Nations Avenue, Taft Avenue, Roxas Boulevard and Padre Burgos Street) serve as key public transport routes that provides access to the main interprovincial public transport hub, the Park N Ride Lawton Bus Station, as well as connection to three Light Rail Transit-1 (LRT1) stations, which are located within the Ermita district (i.e., Central Terminal Station, United Nations Station, and Pedro Gil Station). Because of this, a high number of passenger trips are expected daily, resulting in chronic traffic congestion throughout the day and night. As mentioned, the area receives high pedestrian traffic because of the presence of schools and universities, as well as various commercial businesses and residences. These pedestrian magnets define peak pedestrian volume at different times of the day.

3.2 Survey location

After conducting a visual inspection of the HUC, survey locations were determined based on the following criteria: (a) areas that demonstrate high pedicab demand and supply; (b) areas that attract high pedestrian foot traffic; and (c) areas with a diverse land use mix that include distinct major trip attractors such as malls, universities, and government institutions. Based on this site selection process, 10 survey locations were identified. Table 10 presents each survey location land use attributes and the pedicab-to-walk ratio.

Figure 2a shows the location of the study area (Ermita, Manila) in Manila, while Figures 2b and 2c illustrate the 10 survey locations where face-to-face interviews were conducted. It is also noteworthy to mention that Figure 2b also shows roads where pedicabs are not allowed to operate (indicated in red line). Figure 2c shows the key public transport routes for jeepneys, AUVs, buses, and LRT1, the thicker the lines the more routes served by the road link.

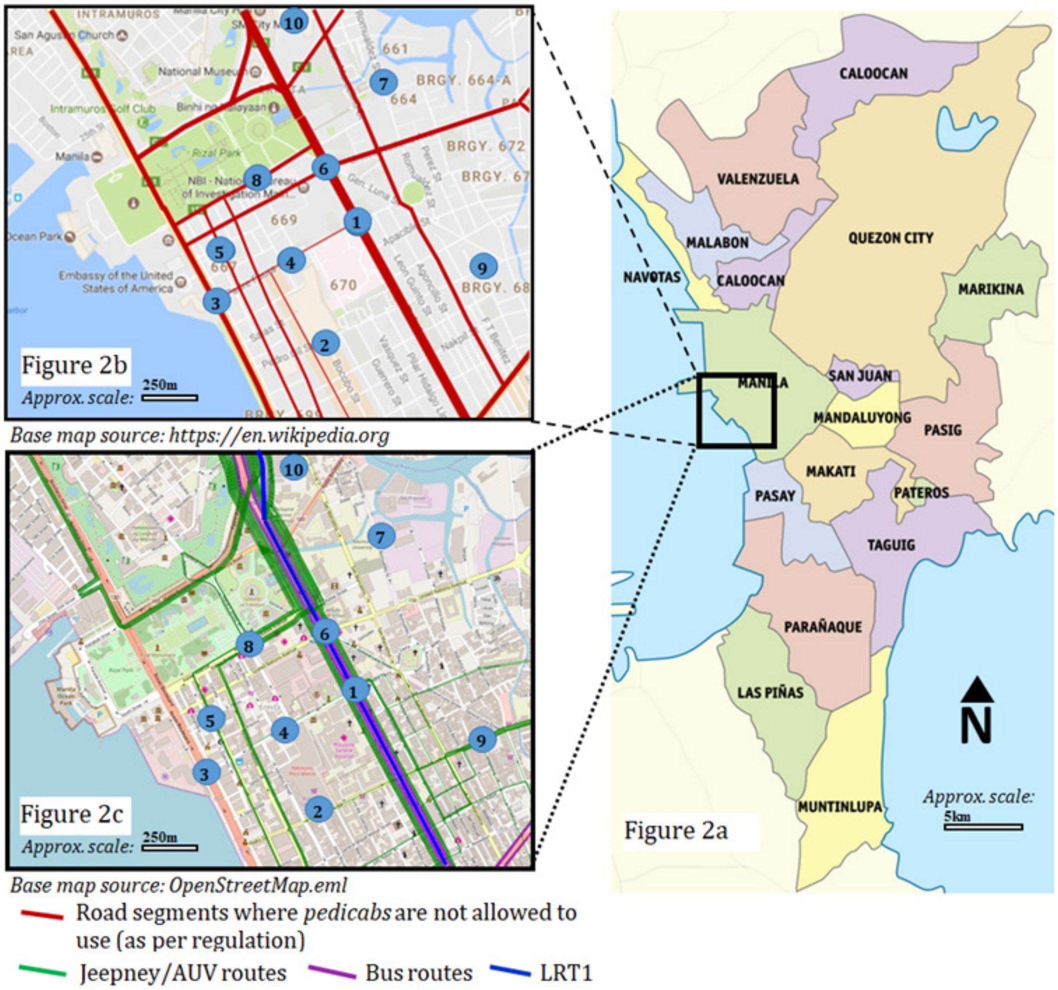

Figure 2: Location and vicinity maps of survey stations in Ermita, Manila

LRT1 is an above-grade rail transit system, which traverses Taft Avenue. Survey locations 1 and 6 are located along LRT1. Survey location 10 is located just a block away from another station. There are also jeepney, AUV, and bus services which ply along Taft Avenue. An additional six (6) secondary streets which are parallel to and seven (7) more which traverses Taft Avenue are served by public utility jeepneys/AUVs in the area. This would mean that, at most, a commuter only needs to walk a distance equivalent to two blocks (approximately 200m-500m) from any of these public transport routes to reach his/her destination in the area. The pedicab, however, is present in these streets, providing service to those who do not like to walk, even though as a rule the pedicab is not allowed along the streets marked in Figure 2b.

Table 1: Station location, land-use characteristics, ratio: number of pedicabs to walking

SL #	STATION LOCATION (SL)	LAND USE CHARACTERISTICS	AM PEAK HOUR COUNT		RATIO (Ped:Walk)
			PEDICAB (N)	WALKING (N)	
1	Light Rail Transit, Pedro Gil Station, Taft Avenue	Mix use of residential, commercial and schools with public transport service available along Taft Avenue and Pedro Gil St.	11	823	1:75
2	Robinsons Place Manila, corner Pedro Gil	Presence of a mall (i.e., Robinson's Place), with a mix of hotels and commercial establishments	45	664	1:15
3	Roxas Boulevard, corner Padre Faura	Mix of small hotels, commercial establishments and residential areas	11	209	1:19
4	Robinsons Place Manila, corner Padre Faura Street Station	The other corner of where Robinson's Place Mall is located with a mixture of commercial and residential areas	22	443	1:21
5	Ermita Church, Antonio Flores Street Station	Presence of a church and a park nearby with a mixture of restaurants and residential areas	18	237	1:14
6	Light Rail Transit, United Nations Ave.& Taft Avenue Sta.	Presence of a hospital, a university, and some commercial and institutional establishments	19	481	1:26
7	Adamson University, Romualdez Street	Presence of a university, mix of small establishments catering to students and some residential areas	16	353	1:23
8	Maria Orosa Street cr. Kalaw Avenue	Presence of hotel, commercial establishments and residential areas	25	388	1:16
9	Paco Market 2011, Pedro Gil Street	Presence of a public market, commercial and residential areas	49	408	1:9
10	SM Manila, San Marcelino Street	Presence of a big mall (i.e., SM Manila) and the Manila City Hall as well as residential areas	54	1,577	1:30
		Overall Sample	270	4163	1:15

3.3 Sampling design and data collection

Surveys were undertaken between 7 a.m. and 12 p.m. during weekdays to capture journey-to-work and journey-to-school trips. The survey was administered among individuals within the selected 10 station catchments. Based on a systematic sampling design, potential respondents were selected based on a random start. They were initially approached at intercept points and invited to participate in the survey. If they agree, surveyors surveyed the respondent. After the interview was completed, the next pedestrian who walks past the intercept point was then asked if he/she were willing to be interviewed. If a potential respondent declined, the next commuter who passed the intercept point was then invited to participate in the study. Given that the time duration of the interview ranged from 7 to 15 minutes, it was important that the moment the survey was completed, the surveyor turned to the next person who passed the intercept point. This process is guided by a similar intercept survey conducted earlier by Schneider (2013). In Schneider's study, it was only after a survey was completed that the next customer who exited the store was invited to participate in the study.

Purposive sampling design, a probability sampling technique, was also employed to ensure that the proportion of male and female, as well as age groups, were well-represented, an approach patterned after the survey of Olawole and Aloba (2014), when they administered a survey to understand the public transport satisfaction of the elderly in Nigeria. It is important to note that given the limited number of pedicab users, most of the passengers who alighted from the pedicab were approached and invited to participate in the survey. As the survey was lengthy, some pedicab passengers were skipped because the surveyors were already occupied with another respondent. On average, two (2) out of five (5) pedestrians and pedicab users who were asked to be interviewed declined. To the extent possible, random respondent selection was ensured, however, in certain situations this may not have been possible given the intermittent arrival at intercept points of pedestrians and pedicab users. Hence, the resulting models must be considered in light of this limitation. Nevertheless, the logit model was able to capture important variables that influence decision making. Moreover, given that the study used non-random samples (Hensher, Rose, & Greene, 2005), the results of the analysis may not be readily transferrable to the larger population of interest but may be used to identify relationships between attributes.

Respondents were queried about the characteristics of their mode preferences (i.e., pedicab use or walking) where both the chosen and the non-chosen modes were described. In addition, participants were also asked about their travel behavior, socio-demographic information, and attitudes toward their choice of first/last mile option.

The walk-to-pedicab ratio was also obtained to further help the researchers in understanding the propensity of use of both modes in each of the 10 survey catchments. This was done by counting the number of pedestrians and pedicabs passing through a specific intercept point during the morning peak hour period (7 a.m.–8 a.m.) during weekdays where there are regular office and school days. Table 1 details the walk to pedicab ratio for each of the 10 catchment stations.

Out of the 700 respondents who participated, 488 (69.8%) were pedestrians and 212 (30.2%) were pedicab users. The number of pedicab respondents who were surveyed was already enough to formulate a robust utility model, satisfying the modeling requirements of the logit choice analysis. Table 2 provides the distribution of samples by access/egress mode in each of the survey location.

Table 2: Survey sample distribution, Ermita, Manila

Access/ Egress Mode Choice	Survey locations									
	Pedro Gil-LRT	Robinsons Mall-P. Gil	Roxas Blvd-P. Faura	Robinsons Mall-P. Faura	Ermita Church	LRT-UN Ave. Station	Adamson Univ.	Maria Orosa St.	Paco Market	SM Mall, Manila
Pedicab	11	22	13	17	17	15	16	38	36	25
Walk	65	32	52	48	33	61	43	58	32	66
Total	76	54	65	65	50	76	59	96	68	91

3.4 Data analysis

The collected data were encoded in a data processing software and formatted for use in a choice modeling software. It used logit choice analysis to identify significant mode-specific as well as qualitative variables to develop the choice model. Further, the socio-economic variables of commuters such as income, age, and gender, among others, were also considered to establish variables that significantly influenced the individual's decision on which first and last mile option to utilize.

Discrete choice modeling (e.g., binary choice) was used to identify the factors that influence modal choice. These models have been used extensively in econometric (Manski & McFadden, 1981) and transportation science (Ben-Akiva & Lerman, 1985). The mode choice process assumes that an individual (who makes the travel choices or the decision maker) first determines the available alternatives and evaluates each alternative in a choice experiment associated with a latent quantity, called utility. The alternative with the highest utility is selected. In general, a discrete choice model is represented by four elements, namely: a) a choice set, b) the socio-demographic attributes of the decision maker, c) attributes describing the alternatives, and d) a random term to represent unobserved errors. In this case, the decision maker is the respondent who either resides or visits the Ermita District. The resulting binary logit model shows the probability outcomes and identifies significant factors of commuters as they choose their access or egress mode. Furthermore, with only two (2) choices, the walk mode is used as the base mode.

4 Results and findings

The following section discusses the outcomes of the analysis. Subsections 4.1 and 4.2 present the socio-demographic profile and travel characteristics of the respondents, respectively, which are crucial to understanding the respondents' attributes. Subsequently, the derived utility models are laid out in Section 4.4 to gain a better understanding of the significant factors influencing the traveler's decision of whether to walk or to take the pedicab.

4.1 Respondents' profile

Socio-demographic attributes offer important insights into the correlates of mode choice. These attributes play a vital role in defining the attitudes and characteristics of individuals concerning their decision to either walk or take the pedicab. Individual characteristics included (a) gender, (b) civil status, (c) work status, (d) trip purpose, (e) age, and (f)income.

Table 3: Socio-economic characteristics of respondents by mode use

VARIABLES	PARAMETERS	Pedicab Users (n=212)	Pedestrians (walk) (n=488)
Gender	Male	81 (38.2%)	261 (53.5%)
	Female	131 (61.8%)	227 (46.5%)
Civil Status	Single	183 (86.3%)	287 (58.8%)
	Married	29 (13.7%)	201 (41.2%)
Work Status	Students	126 (59.4%)	141 (28.9%)
	Employed	81 (38.2%)	323 (66.2%)
	Others	5 (2.4%)	24 (4.9%)
Trip Purpose	Home-based Personal	78 (36.8%)	217(44.5%)
	Home-based Work	23 (10.8%)	157(32.2%)
	Home-based Shop	51 (24.1%)	40(8.2%)
	Home-based School	37 (17.5%)	41(8.4%)
	Home-based Others	23 (10.8%)	33(6.8%)
Average Age (yrs.)		23	21
Average Income/Allowance (Pesos) (1US$ =Php49.7)		6,581.73	8,997.86

Table 3 provides a summary of the individual characteristics of the respondent sample. It shows that a very significant proportion of pedicab users were female (61.8%), while the proportion of male pedestrians (53.5%) was slightly higher than that of female pedestrians (46.5%). The average age of both groups of survey participants, namely, pedicab users and pedestrians were 23 and 21, respectively.

This indicates that both subgroups were relatively young. Majority also reported being single. The respondents reported a diverse set of trip purposes. Given that the area's key trip attractors were universities, a larger proportion of pedicab users were made up of students. Temporary accommodations for students were also abundant in the area, hence explained the high propensity of walking. However, not all students indicated that they were going to school. Other trip purposes cited were personal reasons as well as shopping. There was a low proportion of Home-based School trip purpose reported. Also, even though the students' final destinations were their schools, their immediate destinations at the time of the survey were shopping malls.

4.2 Travel characteristics

To determine the respondent's actual travel distance, referred to in Table 4 as "access/egress distance," pedicab users were asked about their origin and destination locations and the most probable path taken, which is usually the shortest path. These were measured (mean = 1,001m) and were longer than the average walking distance of individuals (mean = 596m). Widowo's study (2008) obtained the average walking distance to access Manila's rail system was lower, at 400 meters, while Daniels and Mulley (2013) found that people will walk longer that 400 meters to access public transport once they have decided to walk. Pedicab users also reported longer travel time compared to pedestrians. These results are expected given the traffic congestion present within Manila's roads which would undoubtedly also affect pedicabs. In terms of costs, walking does not incur any out-of-pocket costs while pedicab users pay about PHP36 per trip (US$0.70).

Table 4: Travel characteristics of pedicab users and walking pedestrians

	Pedicab Users		Pedestrians	
	Mean (S.D.)	Range	Mean (S.D.)	Range
Access/egress distance (in meters)	1,001 (648)	352-1,649	596(419)	177-1,015
Out-of-pocket Cost (Philippine pesos)	36(17)	19-53	0.0	-
Income or allowance/month (Philippine pesos)	14,258 (8,637)	5,621-22,895	14,260(13,587)	673-27,847
Travel time (minutes)	21(15)	6-36	14(12)	2-27

4.3 Utility models

The variables considered in the choice modeling included choice set, mode- and route-specific variables as well as socio-economic or generic variables. The choice set was whether to use the pedicab or walk. The mode-specific variables included time of travel (TIME), cost of travel (COST), and waiting time (WAIT) for pedicabs while route-specific variables include distance over safety (DISAFE), safety rating (SAFETY), accessibility rating (ACCESS) and walking environment rating (ENVIRO). An additional combination variable was also developed such as cost over travel time (COSTIM) variable. The generic variables include being male or female (GENDER), age (AGE), with child companion (WCHILD), working age (WRKAGE) and with baggage (WBAG).

Given that some respondents gave incomplete answers to certain important variables, their respective questionnaire forms were simply rejected. Hence, out of 700 original samples, only 575 samples were used in the choice modeling analysis. To improve on the next iteration of this study, it is important that an analysis of possible bias be included if survey responses are eliminated. Table 5 shows the summary definition of variables utilized, their model names and descriptions.

Table 5: Variables considered in choice modeling whether to use the pedicab or walk

Variable	Model Name	Description
Choice	Choice	Pedicab or walk
Mode- and route-specific variables		
Constant	ASC	Alternative-specific constant
Time	TIME	Access or egress travel time (minutes)
Cost	COST	Cost of travel using pedicab, zero for those who walk
Wait time	WAIT	Wait time for the pedicab, value is zero for those who walk
Out-of-pocket cost over travel time	COSTIM	Out-of-pocket cost (e.g. fare) (PHP) divided by travel time (minutes)
Distance over Safety	DISAFE	Distance over safety rating
Safety rating of walkway	SAFETY	Perceived safety rating, includes both walkway design and traffic volume from 5 to 1, with 5 as the safest and 1 the least safe
Accessibility rating of walkway	ACCESS	Accessibility rating of walkway from 5 to 1, with 5 as the most accessible and 1 as the least accessible
Walking environment rating	ENVIRO	Environmental condition rating of walkway from 5 to 1 with 5 with the best environment for walking and 1 as the least environment-friendly
Generic variables		
Gender of respondent	GENDER	Dummy variable, 1 if male and 0 if female
Age of respondent	AGE	Age of respondents in years
With child companion	WCHILD	Dummy variable, 1 if with child companion during travel, 0 otherwise
Work age	WRKAGE	Dummy variable, 1 if of working age, 0 otherwise
With baggage	WBAG	Dummy variable, 1 if with baggage during travel, zero otherwise

Initial screening was done to weed out other variables. Considering all the important variables in Table 5, the development of the utility models between the choice of riding a pedicab or walking resulted in several significant variables. Their coefficients and these variables are shown in Table 6.

As shown in Table 6, TIME and COST variables are significant at 1%. While TIME is negatively correlated, hence, a disutility, COST presents a positive relationship, which should not be, being also a disutility. For route-specific variables, ACCESS, at 1% level of significance is positive since people will travel to an area with high accessibility rating. SAFETY, at 1% level of significance, is also positive since people will use a road with high safety rating. For the socio-economic variables, only WRKAGE is significant at 1% but demonstrate a negative relationship, which would mean that people of working age tend not to use the pedicab. The rest of the variables, their coefficients, and statistical significance as well as the statistical measures of the developed model are also provided in Table 6.

To find the variables which would influence people's mode choice decisions and determine the most appropriate utility model, it is important to first identify significant variables in the general model presented in Table 6. Identifying the group of significant variables is an iterative process until the modeler is satisfied with the correct sign and significance of each variable in the developed utility model.

Table 6: General logit choice estimation results using all variables

Variables	Coefficient	T-Stat	P-Value
ASC	0.13623	0.245	0.8067
TIME ***	-0.06573	-5.106	0.0000
COST***	0.02942	3.546	0.0004
WAIT	-0.04697	-1.198	0.2311
COSTIM*	-0.08752	-1.712	0.0869
DISAFE	-0.00087	-0.815	0.4148
SAFETY ***	0.48921	3.127	0.0018
ACCESS ***	0.45750	4.288	0.0000
ENVIRO	0.11888	1.100	0.2713
GENDER	-0.34558	-1.412	0.1578
AGE	-0.02849	-1.478	0.1394
WCHILD	0.17831	0.802	0.4224
WRKAGE***	-0.92975	-2.734	0.0063
WBAG	-0.08916	-0.303	0.7618
No. of observations			575
Pseudo R^2			0.39884
Adj. R^2			0.38237
Log-Likelihood			-363.9023
LR chi^2 [13]			270.72813
Prob> chi ^2			0.00000

*significant @ 10%, ** significant @5%, *** significant @1%

Table 7 provides the final model with all variables having at least 10% level of significance. The mode-specific variables whose signs are expected to be negative are TIME (significant at 1%) and COSTIM (significant at 5%). For travel time (TIME); the longer the travel time, whether using the pedicab or walking, the higher the disutility. The COSTIM variable is also negative since people will use the pedicab when it is cheaper for a given travel time, while this variable is always zero for those who walk since walking will incur zero out-of-pocket cost. Furthermore, the COSTIM coefficient is slightly negatively higher than the TIME coefficient, which would mean that, on the average, commuters consider out-of-pocket cost more than travel time in their decision to choose an access or egress mode.

SAFETY and ACCESS have positive utilities since people will use the pedicab or walk if the area has high safety and accessibility ratings. The greater coefficient of SAFETY than ACCESS variable signifies that commuters value safety of the walkway more than accessibility. The significant generic and socio-economic variables include GENDER, AGE, WCHILD, and WRKAGE. For the GENDER variable, the negative sign of the coefficient means male commuters do not prefer to use pedicabs and for AGE, the negative sign of the coefficient means older people do not prefer to use pedicabs. In the case of the WCHILD variable, the positive sign means that if the commuter is with a child companion, he/she would prefer to use a pedicab than to walk. For the WRKAGE dummy variable, the negative sign indicates that people who are of working age do not prefer to use the pedicab. The WRKAGE coefficient, which is almost twice greater than the GENDER coefficient, signifies that working age individuals are doubly less likely to use the pedicab than males, all else being equal. Only TIME, SAFETY and ACCESS have a significance level of 1%, reinforcing earlier studies by Panter and Jones (2010); the rest have either a 5% or 10% level of significance. The rest of the statistics are shown in Table 7.

Table 7: Logit choice model estimation results to use pedicab or walk

Variables	Coefficient	T-Stat	P-Value
ASC *	0.70966	1.838	0.0661
TIME ***	-0.06988	-5.612	0.0000
COSTIM **	-0.08950	-1.973	0.0485
SAFETY ***	0.67771	6.188	0.0000
ACCESS ***	0.47062	4.710	0.0000
GENDER*	-0.40372	-1.722	0.0852
AGE*	-0.03406	-1.933	0.0533
WCHILD *	0.37705	1.779	0.0752
WRKAGE**	-0.79443	-2.501	0.0124
No. of observations			575
Pseudo R^2			0.41112
Adj. R^2			0.40176
Log-Likelihood			-398.5596
LR chi^2 [8]			287.58876
Prob> chi ^2			0.00000

*significant @ 10%, ** significant @5%, *** significant @1%

Noting that walking is the base mode, the utility models developed for the pedicab (Up) and for walking (Uw) are as follows

$$U_p = -0.06988TIME - 0.08950COSTIM + 0.67771SAFETY + 0.47062ACCESS - 0.40372GENDER - 0.03406AGE + 0.37705WCHILD - 0.79443WRKAGE + 0.70966 \quad (1)$$

$$U_w = -0.06988TIME - 0.08950COSTIM + 0.67771SAFETY + 0.47062ACCESS \quad (2)$$

As shown in Table 8, the cross-tabulation matrix reports that the model correctly predicted a proportion of around 79.9% of those who walk; while for pedicab users, the model was only able to correctly predict 65.6%. Overall, 429 out of 575 mode choices (74.6%) were correctly predicted by the model.

Table 8: Crosstab matrix of predicted versus actual choice

	Pedicab	Walk	Total
Pedicab	139 (65.6%)	73	212
Walk	73	290 (79.9%)	363
Total	212	363	575

5 Discussion and conclusion

Planning for transport in Historic Urban Centers (HUCs) supports the proposition that non-motorized transport (NMT) continues to be a real and vital transportation option in these settings. Significant proportions of individuals within HUCs still walk or take a pedicab to undertake their first or last mile trip. Because HUCs are characterized by a compact land use mix, narrow roads and short trip distances between origin and destination, NMT, such as walking and taking the pedicab, becomes an attractive and highly viable alternative. For instance, in Ermita, the presence of several higher education institutions adjacent to retail, commercial and retail establishments as well as to mid- to high-rise residential condominiums tend to attract high levels of pedestrian and pedicab traffic at different times of the day.

By investigating the factors which influenced an individual's decision to walk or to take the pedicab as their preferred first and last mile trip option, this study revealed important insights into the role of walking and the use of pedicab within Ermita's historic streets. The logit model presented the probability outcomes and identified the significant factors that influenced pedestrian and pedicab users' decision making as they chose their preferred access or egress mode. Moreover, this research also established that the first and last mile transport mode choice is influenced by travel and socio-economic characteristics of respondents (pedicab users and pedestrians), as well as the characteristics of the built environment.

Variables which are statistically significant determinants of pedestrian travel decisions include: (a) travel time, (b) cost over travel time, (c) safety perception of the area, (d) accessibility perception of the area, and (e) socio-economic variables including gender, age, traveling with a child companion, and working age during travel. On the other hand, pedicab users tend to travel longer distances, with each completed trip approximately a kilometer long; and women, as well as those who were accompanied by children, preferred riding pedicabs over walking. These findings not only corroborate earlier research but they also reinforce how this information could help strengthen the evidence base to inform planning and current policies.

Results also showed that built environment characteristics such as safety and accessibility influence pedestrian travel decisions. Streets that are generally perceived as lacking in safety discourage pedestrians from walking within the area, and in the process, severely limit their participation in social, economic and other opportunities. These findings also support the results of a 2013 WHO study on road safety which reports that the proportion of road fatalities is highest among pedestrians.

Action is urgently called for to align with the newly adopted 2030 Agenda for Sustainable Development. SDG3 aspires to halve the global number of deaths and injuries from road traffic crashes by 2020. Without sustained action, WHO predicts that road traffic injury-related fatalities would be the seventh leading cause of death by 2030. Countries and cities must work hand in hand to introduce and enforce plans and policies that create walk/ride-friendly communities. Such plans may include the integration of crime-prevention through environmental design strategies (CPTED) (Clancey, Fisher, & Lee, 2012), place-making strategies (Friedmann, 2010), traffic calming interventions (Mohit, Rosen, & Muennig, 2017) and/or the implementation of do-it-yourself (DIY) urbanism projects (Talen, 2015) in urban centers and historic districts, highlighting the importance of projects and programs that deliver maximum impact but involve minimum development cost. Enhancing the physical environment to encourage NMT such as walking and taking the pedicab do not only provide safer and more secure street environment that could address both perceived and actual observations of safety and security but it can also facilitate a more active lifestyle as well as create and sustain a more sustainable mobility culture for all.

Pedicabs are informal, non-motorized means of public transport. They complement other transport modes and are well-suited for shorter trip distances. They are particularly beneficial in areas that are already too arduous for walking, especially for older adults and children. Driving a pedicab offers a vital source of livelihood for many residents in Manila while also offering a safer transport option for vulnerable groups such as women, children and the elderly. Therefore, national, regional and local level policies must acknowledge the growing role of pedicabs as important players in the transport system. Also, the alignment of routes and regulations for pedicab services as part of an overall transport service provision is therefore imperative and crucial. Failure to rationalize their conveyances may lead to undesirable outcomes.

Through this process, there is a need to identify stakeholders who are directly (or indirectly) involved with transportation policy development, implementation and operation of pedicabs, from national government agencies (e.g., Department of Transportation), metropolitan/regional agencies (e.g., Metropolitan Manila Development Authority), local entities (e.g., organization of pedicab drivers and operators) and pedicab operators. More importantly, there is a need to offer a platform that would allow them to "lean in" and participate in the planning and policy making process.

So as not to reinvent the wheel, it is necessary to align and anchor NMT strategies with current and planned infrastructure developments. For instance, in public transport expansion, there is a need to coordinate routing, cycling infrastructure provision and road sharing design with other projects to avoid replication of efforts and result in savings in time, money and effort. To undertake infrastructure improvements for safer walkway environments for pedestrians, an example would be the development of a multimodal corridor or the implementation of a uniform textured sidewalk pavement within downtown to create the perception of a continuous pedestrian path. It allows the breakdown of sidewalk pavement that suits human proportions, making the area attractive to pedestrian use, while considering the implications of walking to individual, population-level health outcomes and overall quality of life.

To achieve this, additional research is required to understand the role of each mode in terms of delivering the most effective, sustainable and inclusive mobility networks. For example, the following questions can help direct future research: How can walking and the use of pedicabs be considered as significant components in the overall trip sequence? In some cases, how can walking and cycling serve as viable alternatives to motorized transport? How can they complement public transit? Moreover, fundamental research is needed in defining factors that would affect the travel behavior of pedestrians or the use of pedicabs as part of an inter/multimodal transport network or as a component of a trip chaining behavior. It is important to understand the current role that each mode plays in the context of developing city transportation system to support more effective and evidence-based plan and policymaking, with the end goal of achieving healthy, safe, inclusive and secure city environments.

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